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ABSTRACT

In further exploring the relationship between teacher behaviors and student learning, this study, part of the National Study of Student Learning, examined how teacher organization and preparation and teacher skill and clarity influenced the development of general cognitive skills in the first year of college. A sample of 2,302 students attending 18 diverse four-year institutions from 15 states throughout the country participated. Data collected in Fall 1992 included a precollege survey that gathered information on student demographic characteristics and background, as well as aspirations, expectations of college, and items assessing orientation to learning. Students also completed the Collegiate Assessment of Academic Proficiency (CAAP) measure. A follow-up testing took place in Spring 1993. Results showed that, when controlling for precollege cognitive level and academic motivation, the average cognitive level of the incoming class at each institution, ethnicity, gender, age, level of enrollment, work responsibilities, and course-taking patterns, the extent to which students judged the overall instruction as high in teacher organization and preparation was significantly and positively associated with end-of-first year reading comprehension, mathematics, critical thinking, and composite cognitive development. Additional analysis suggested that the net cognitive impacts of teacher organization and clarity were general rather than conditional. (Contains 47 references.) (JB)

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EFFECTS OF TEACHER ORGANIZATION/PREPARATION AND TEACHER SKILL/CLARITY ON GENERAL COGNITIVE SKILLS IN COLLEGE*

ED 374 730

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Abstract

This study sought to determine the extent to which two salient teacher behaviors, teacher organization and preparation and teacher skill and clarity, influenced the development of general cognitive skills int he first year of college. The sample was 2302 students attending 18 diverse four-year institutions from 15 states throughout the country. Controlling for precollege cognitive level and academic motivation, the average cognitive level of the incoming class at each institution, ethnicity, gender, age, level of enrollment, work responsibilities, and course taking patterns, the extent to which students judged the overall instruction received during their first year of college as high in teacher organization and preparation was significantly and positively associate with end-of-first year reading comprehension, mathematics, critical thinking, and composite cognitive development. In the presence of the same controls a scale measuring teacher skill and clarity in overall instruction received was only trivially and non-significantly associated with the four cognitive outcomes. Additional analyses suggested that the net cognitive impacts of the two teacher behaviors were general rather than conditional.

A substantial amount of research has addressed the relationships between different dimensions of teacher behavior and student learning (e.g., Benton, 1982; Cashin, 1988; Centra, 1977, 1979, 1989; Cohen 1980, 1981, 1987; Costin, Greenough, & Menges, 1971; d'Appolonia & Abrami, 1988; Feldman, 1989, 1990, 1994; Marsh, 1984, 1986; Marsh & Duncan, 1992; 1987; Marsh, Fleiner & Thomas, 1975; McKeachie & Lin, 1970; Mintzes, 1982; Murray, 1980, 1985, 1990; Sullivan, 1985; Sullivan & Skanes, 1974). Fortunately there have been a number of useful reviews and summaries of this research (e.g., Cashin, 1988; Cohen, 1981, 1987; Marsh, 1987; Feldman 1989, 1994). What is clear from these syntheses of research is that student ratings or descriptions of teaching behavior are multidimensional and that the different dimensions vary substantially in the strength of their relationship with course achievement. For example Cohen (1981, 1987) concluded that there were eight general dimensions of student ratings of teacher behavior or instruction: skill, rapport, structure, difficulty, interaction, feedback, evaluation, and interest motivation. Feldman (1989, 1994), however, suggests that there may be as many as 28.

Despite different perspectives on the dimensionality of teacher behaviors, there appears to be a marked agreement with respect to those dimensions most strongly linked with student achievement. Two dimensions consistently stand out. They are teacher organization and preparation (e.g. "class time is used well," "presentation of material is well organized") and teacher instructional skill and clarity (e.g., "the teacher gives clear explanations", "the teacher makes good use of examples and illustrations to get across difficult points"). Hereafter we will refer to these two dimensions as teacher organization/preparation and teacher skill/clarity. In Cohen's (1981) meta-analysis the teacher skill/clarity dimension had an average correlation of

.50 with course subject matter achievement, while the organization/preparation dimension had an average correlation of .47 with achievement. The next highest correlation between a teacher behavior dimension and student achievement was only .31. Similarly, Feldman's more recent (1989, 1994) and extensive meta-analysis also showed that, of all the teacher behavior dimensions considered, teacher skill/clarity and teacher organization/preparation had the highest correlations with student achievement, .56 and .57 respectively. What is perhaps most interesting about such consistent findings is that several of the constituent skills that comprise these two teacher behavior dimensions (e.g., structuring and organizing class time efficiently, effective use of examples, learning to present material clearly) may themselves be learnable (Dalgaard, 1982; Land, 1979, 1981; Land & Smith, 1979, 1981; Pascarella & Terenzini, 1991; Smith, 1982).

Although we can be reasonably confident about the substantial and consistent links between teacher organization/preparation and teacher skill/clarity on the one hand and student achievement on the other, our knowledge is essentially limited to the relationship between these two dimensions of teacher behavior and knowledge acquisition in specific courses. We know almost nothing about the extent to which teacher organization/preparation and teacher skill/clarity may influence more general and broad-based measures of student cognitive development than those tapped by course-level achievement tests. We are similarly uninformed about the degree to which these two dimensions of teacher behavior manifest their influence in a broader context than an individual course. Specifically, do the extent of teacher preparation/organization and teacher skill/clarity in a student's overall academic experience influence general cognitive outcomes during college?

Finally, inquiry on the relationship between teacher behaviors and student achievement has focused almost exclusively on general effects. That is, it assumes that the learning enhancements of teacher organization/preparation and teacher skill/clarity are similar in magnitude for all students. It may be the case, however, that the effects of these two dimensions of teacher behavior on student learning are conditional rather than general. That is, they vary in their influence on achievement for students with different background or other characteristics (e.g., gender, ethnicity, age, precollege academic preparation or motivation).

The present study sought to address these issues in a longitudinal study of student first-year cognitive development in 18 colleges and universities around the country. The study had two specific purposes. First, it attempted to assess the net effects of teacher organization/preparation and teacher skill/clarity on students' first-year development in reading comprehension, mathematics, critical thinking, and composite cognitive development. In doing so it employed standardized instruments specifically designed to assess general cognitive skills acquired in the first two years of college. Second, it attempted to determine the extent to which the cognitive effects of teacher organization/preparation and teacher skill/clarity differ in magnitude for students with different background and other characteristics.

Method

Institutional Sample

The sample was selected from incoming first-year students at 18 four-year colleges and universities located in 15 different states throughout the country. Institutions were selected from the National Center on Educational Statistics IPEDS data base to represent differences in

colleges and universities nationwide on a variety of characteristics including institutional type and control (e.g. private and public research universities, private liberal arts colleges, public and private comprehensive universities) size, location, commuter versus residential, and the ethnic distribution of the undergraduate student body. In aggregate, the student population of those 18 schools approximated the national population of undergraduates in four-year institutions by ethnicity and gender.

Student Sample and Instruments

The individuals in the overall sample were 2416 first-year students who participated in the National Study of Student Learning (NSSL), a large longitudinal investigation of the factors that influence learning and cognitive development in college. The research was sponsored by the federally-funded National Center on Postsecondary Teaching, Learning, and Assessment. The initial sample was, as far as possible, selected randomly from the incoming first-year class at each participating institution. The students in the sample were informed that they would be participating in a national longitudinal study of student learning and that they would receive a stipend for their participation. They were also informed that the information they provided would be kept confidential and would never become part of their institutional record.

An initial data collection was conducted in the Fall of 1992. The data collection lasted approximately three hours and students were paid a stipend of $25 by the National Center on Postsecondary Teaching, Learning, and Assessment. Students were reminded that the information they provided would be kept in the strictest confidence and that all that was expected of them was that they give an honest effort on tests and a candid response to all questionnaire

items. The data collected included a precollege survey that gathered information on student demographic characteristics and background, as well as aspirations, expectations of college, and a series of items assessing their orientations toward learning. Participants also completed Form 88A of the Collegiate Assessment of Academic Proficiency (CAAP). The CAAP was developed by the American College Testing Program (ACT) specifically to assess selected general cognitive skills typically acquired by students in the first two years of college (ACT, 1990). The total CAAP consists of five 40-minute, multiple-choice test modules, three of which--reading comprehension, mathematics, and critical thinking--were administered during the first data collection.

The CAAP reading comprehension test is comprised of 36 items that assess reading comprehension as a product of skill in inferring, reasoning, and generalizing. The test consists of four prose passages of about 900 words in length that are designed to be representative of the level and kinds of writing commonly encountered in college curricula. The passages were drawn from topics in fiction, the humanities, the social sciences, and the natural sciences. The KR-20, internal consistency reliabilities for the reading comprehension test range between .84 and .86. The mathematics test consists of 35 items designed to measure a student's ability to solve mathematical problems encountered in many postsecondary curricula. The emphasis is on quantitative reasoning rather than formula memorization. The content areas tested include pre-, elementary, intermediate, and advanced algebra, coordinate geometry, trigonometry, and introductory calculus. The KR-20 reliability coefficients for the mathematics test ranged between .79 and .81. The critical thinking test is a 32-item instrument that measures the ability to clarify, analyze, evaluate, and extend arguments. The test consists of four passages that are

designed to be representative of the kinds of issues commonly encountered in a postsecondary curriculum. A passage typically presents a series of subarguments that support a more general conclusion. Each passage presents one or more arguments and uses a variety of formats, including case studies, debates, dialogues, overlapping positions, statistical arguments, experimental results, or editorials. Each passage is accompanied by a set of multiple choice items. The KR-20 reliability coefficients for the critical thinking test ranged from .81 to .82 (ACT, 1990). In pilot testing of various instruments for use in the National Study of Student Learning on a sample of 30 college students the critical thinking test of the CAAP was found to correlate .75 with the total score on the Watson-Glaser Critical Thinking Appraisal.

Each of the 18 institutions was given a target sample size relative in magnitude to the respective sizes of the first-year class at each institution. The overall target sample for the Fall 1992 data collection at the 18 institutions was 3,910. The overall obtained sample size, (i.e., those students actually tested) for the Fall 1992 data collection was 3331, or a response rate of 85.19%.

A follow-up testing of the sample took place in the Spring of 1993. This data collection required about 3 1/2 hours and students were paid a second stipend of $35 for their participation by the National Center on Postsecondary Teaching, Learning, and Assessment. Collected during the follow-up testing were Form 88B of the CAAP reading comprehension, mathematics and critical thinking modules as well as questionnaire instruments that sought to measure an extensive range of students' experiences during the first year of college. Embedded in the questionnaire were a set of items that asked about the kinds of teaching received. The introduction for these items was as follows:

We would like to get your views on the overall nature of the teaching you received during the past year. We want to know, in general, how your teachers taught and what you did in class. Please circle the number on the scale below that indicates how often you have experienced the following in you coursework as a whole.

The possible responses to each item were adapted from the College Student Experiences Questionnaire (PACE, 1984, 1987, 1990). The responses were: "never", "occasionally", "often", or "very often," coded from 1 to 4 respectively.

In developing this part of the questionnaire two scales were developed a priori to tap teacher organization/preparation and teacher skill/clarity. In developing the scales we were guided by the constituent items that appear to load on these particular dimensions of teacher behavior in existing research (e.g., Cohen, 1981, 1987; Feldman 1989, 1994). The items comprising each scale, the correlation between each item and the total scale, and the alpha (internal consistency) reliabilities for the scales are shown in Table 1.

Place Table 1 About Here

Of the original sample of 3331 students who participated in the Fall, 1992 data collection 2416 participated in the Spring, 1993 data collection, for a follow-up response rate of 72.53% Given the high response rates at both testings it is not particularly surprising that the sample was reasonably representative of the population from which it was drawn. However, to adjust for potential response bias by gender, ethnicity, and institution a sample weighting algorithm was developed. Specifically, within each of the individual institutions participants in the follow-up

data collection were weighted up to the institution's first-year population by gender (male or female) and ethnicity (white, black, hispanic, other). Thus, for example, if an institution had 100 black men in its first-year class and 25 black men in the sample, each black male in the sample was given a sample weight of 4.00. An analogous weight was computed for participants falling within each gender x ethnicity cell within each institution. The effect of applying sample weights in this manner was to adjust not only for response bias by gender and ethnicity, but also for response bias by institution.

Analytical Model

The independent variables of interest in the study were the teacher organization and preparation scale and the teacher instructional skill and clarity scale. The dependent variables were Spring 1993 scores on the CAAP reading comprehension, mathematics, and critical thinking tests, plus a measure of freshman year composite cognitive development that combined all three tests. The composite cognitive development measure was constructed in two steps. First each of the three CAAP tests (i.e., reading comprehension, mathematics, and critical thinking) was standardized to put each on the same metric. Subsequently the composite cognitive development score was computed by summing across standardized scores. The alpha, internal consistency, reliability for the composite cognitive development measure was .83.

Because of the extraneous factors that might influence both how students perceive the teaching they receive in college and their cognitive growth during the first year of college, it is likely that simple correlations would yield a spuriously inflated estimate of the impact of specific teaching behaviors on students' first-year cognitive development (e.g., Feldman, 1994;

Pascarella, 1985; Pascarella & Terenzini, 1991). Consequently a number of potentially important confounding variables were also included in the analytic model. In selecting those salient confounding variables we were guided by the existing body of evidence on the factors independently influencing learning and cognitive development during college (e.g., Astin, 1968, 1977, 1993; Astin & Panos, 1969; Kuh, 1993; Pascarella, 1985; Pascarella & Terenzini, 1991). The individual-level confounding variables incorporated in the analytical model were the following

1. Individual precollege (Fall, 1992) CAAP reading comprehension, mathematics, critical thinking, and composite cognitive development scores [each employed in prediction of the appropriate end-of-first-year (i.e., Spring, 1993) CAAP reading comprehension, mathematics, critical thinking, and composite cognitive development score].

2. Precollege (Fall, 1992) academic motivation: an eight-item, Likert-type scale (5 = strongly agree to 1 = strongly disagree) with an internal consistency reliability of .65. The scale items were developed specifically for the NSSL, and were based on existing research on academic motivation (e.g., Ball, 1977). Examples of constituent items are: "I am willing to work hard in a course to learn the material, even if it won't lead to a higher grade," "When I do well on a test it is usually because I was well prepared, not because the test was easy," "In high school I frequently did more reading in a class than was required simply because it interested me." and "In high school I frequently talked to my teachers outside of class about ideas presented during class."

3. Gender: coded: 2 = female, 1 = male.

4. Ethnicity: coded: 2 = non-white, 1 = white.

5. Age

6. Number of credit hours taken: total number of credit hours each student expected to complete during the first year of college (taken from the follow-up questionnaire).

7. Number of hours worked: total number of hours a student worked per week both on- and off-campus (taken from the follow-up questionnaire).

8-12. Number of courses taken during the first year of college in five different areas: natural sciences (e.g., biology, chemistry, engineering, geology, physics); arts and humanities (e.g., art history, composition, English literature, foreign languages, philosophy, classics); social sciences (e.g., economics, psychology, history, sociology, political science, social work); mathematics (e.g., algebra, calculus, statistics, computer science, geometry, matrix algebra); and technical or pre-professional (e.g., business, education, physical education, nursing, physical therapy, drafting). Respondents were given 61 different courses across the five broad areas to select from, and were asked to indicate how many of each of the 61 courses they had taken during their first year of college (coded from 0 to 5). This information was taken from the follow-up questionnaire.

Because the existing body of evidence suggests that institutional context can play a role in shaping the impact of college in indirect, if not direct, ways, we also included one institutional-level variable in the analytic model. This was:

13. The average level of academic preparation of each institution's first-year class: this was estimated by the average precollege (Fall, 1992) CAAP reading comprehension, mathematics, critical thinking, or composite cognitive development score for the sample of first-year students at each of the 18 institutions. Each individual student in the sample was given the

mean of his or her institution on all three CAAP tests plus the composite, and each of the institutional mean estimates was employed in analysis of the appropriate end-of-first year (Spring, 1993) individual-level reading comprehension, mathematics, critical thinking or composite cognitive development score.

The first stage in the analysis sought to estimate the net impact of teacher organization/preparation and teacher skill/clarity on the four first-year cognitive outcomes controlling for the potential confounding influences delineated above. Thus, using ordinary least squares, each of the four end-of-first year cognitive outcomes (i.e., Spring, 1993 reading comprehension, mathematics, critical thinking, and composite cognitive development) was regressed on all of the 13 potentially confounding influences plus the teacher organization/preparation and the teacher skill/ clarity scales.

In the second stage of the analyses we tested for the presence of conditional effects (Pedhazur, 1982). A series of cross-product terms was computed between teacher organization/preparation and teacher skill/clarity on the one hand and each of the 13 other variables in the model. These were then added to the regression model employed in the first stage of the analyses (i.e., the main-effects model). The addition of the sets of cross-products was done separately for each of the teacher behavior scales. A statistically significant increase in explained variance (R^2) attributable to the set of cross-product terms (over and above the main-effects model) indicates that the net effects of teacher organization/preparation and teacher skill/clarity vary in magnitude for students at different levels on the other variables in the prediction model. Tests for conditional effects were also conducted to determine if the cognitive effects of teacher organization/preparation varied at different levels of teacher skill/clarity, and

vice versa.

Of the 2416 students participating in the follow-up testing, complete data for the different analyses conducted in the study were available for 2302 students. Based on the weighted sample, these 2302 participants represented a population of 24,503 first-year students at the 18 four-year colleges and universities. The weighted sample (N = 24,503), adjusted to the actual sample size (N=2302) to obtain correct standard errors, was used in all analyses. Because of the large (unweighted) sample size the critical alpha level was set at .01.

RESULTS

Table 2 summarizes the results of the regression analyses for end-of-first-year reading comprehension, mathematics, critical thinking, and composite cognitive development. (The means, standard deviations, and intercorrelations among all variables in the analyses are available from the first author on request.) As the table shows, in the presence of controls for such factors as precollege cognitive level and academic motivation, demographic characteristics, extent of enrollment and work responsibilities, the number of courses taken in five different areas, and teacher skill/clarity, the teacher organization and preparation scale had significant and positive, though modest, associations with all four cognitive outcomes. Controlling for the same confounding influences, plus teacher organization/preparation, the teacher skill and clarity scale had only trivial and non-significant associations with the four end-of-first year cognitive measures.

Table 2 About Here

One potential problem with the regression results summarized in Table 2 is that there is considerable multicolinearity among the two teacher behavior scales. Indeed the zero-order correlation between teacher organization/preparation and teacher skill/clarity was .68. Thus, their mutual presence in a regression equation could easily suppress the unique contribution of either or both scales (Pedhazur, 1982). To investigate this possibility we computed the partial correlations between each teacher behavior scale and the four first-year cognitive outcomes. In computing these partial correlations we statistically removed the confounding influence of all other variables in the analytic model except the other teacher behavior scale. The results of these analyses, along with the zero-order correlations of each teacher behavior scale with each cognitive measure, are shown in Table 3.

Place Table 3 About Here

As Table 3 indicates, both the zero-order and partial correlations of the teacher organization/preparation scale with each cognitive outcome were substantially larger than the corresponding correlations between teacher skill/clarity and each cognitive outcome. Indeed, only two of the zero-order and one of the partial correlations between skill/clarity and the four cognitive measures were statistically significant. Such findings suggest that, despite substantial multicolineaity, the regression results present a reasonably accurate estimate of the relative impact of teacher organization/preparation and teacher skill/clarity on the end-of-first year cognitive dimensions considered.

In the second stage of the analyses the addition of the cross products of the two teacher

behavior scales and all other variables in the model were consistently associated with small and non-significant increases in the variance explained in each of the four cognitive outcomes. The average R^2 increase associated with the addition of each set of cross-product terms to the main-effects equation was .0036 (.36%), and the largest R^2 increase was less than one-half of one percent. Similarly, the addition of the cross-product of teacher organization/preparation *X* teacher skill/clarity to the main effects equation was associated with a non-significant increase in the explained variance of all four cognitive outcomes. Such findings suggest that the net cognitive impacts of teacher organization/preparation and teacher skill/clarity are general rather than conditional. That is, the net impacts of these two teacher behavior dimensions shown in Table 2 tend to be similar in magnitude, irrespective of a student's particular position or score on any of the other variables in the regression equations.

SUMMARY AND DISCUSSION

Previous research has indicated that two teacher behavior dimensions, teacher organization and preparation and teacher skill and clarity, consistently stand out in terms of their positive associations with student course achievement. The present study sought to determine if the impacts of these salient teacher behaviors are generalizable in two respects. First, do the impacts of teacher organization/preparation and teacher skill/clarity extent to the overall nature of the teaching received in college? Second, are the impacts of these two teacher behaviors discernable on more broadly conceived dimensions of student cognitive proficiency than specific course achievement? These questions were addressed in analyses of data from 2302 students attending 18 diverse four-year colleges and universities located in 15 states throughout the

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country. Controlling for such potentially confounding influences as precollege cognitive level and academic motivation, the average cognitive level of the incoming class at each institution, ethnicity, gender, age, extent of enrollment, work responsibilities, and the number of courses taken in five broad areas, the extent to which students judged the overall instruction received during their first year of college as characterized by a high level of teacher organization and preparation was significantly and positively associated with end-of-first year reading comprehension, mathematics, critical thinking, and composite cognitive development. In the presence of the same controls a scale measuring teacher skill and clarity in overall instruction received was only trivially and non-significantly associated with the four end-of-first year cognitive outcomes.

Additional analyses suggested that the net cognitive impacts of teacher organization/preparation and teacher skill/clarity are general rather than conditional. That is, their impacts on four end-of-first year cognitive outcomes were similar in magnitude irrespective of variations in a student's precollege cognitive level or academic motivation, age, ethnicity, gender, work responsibilities, extent of enrollment, type of coursework taken, and the estimated average cognitive proficiency of the incoming class at the institution attended. Similarly, the positive cognitive impacts of teacher organization and preparation appeared to be similar in magnitude irrespective of the extent to which teacher skill and clarity characterized the overall instruction received during the first year of college.

The findings of the study have at least two implications for the body of evidence pertaining to the validity and usefulness of student evaluations or perceptions of teaching. First they suggest that the positive link between teacher organization/preparation and specific course

achievement may extend to the impact of a student's total first-year instructional experience on more broad-based, general cognitive proficiencies. The dependent measures in this investigation were general cognitive skills such as reading comprehension and critical thinking that may have only weak links to specific course content (Pascarella & Terenzini, 1991). Moreover, even when controls were made for the number of mathematics, engineering, and natural sciences courses taken, level of teacher organization and preparation in overall instruction received during the first year of college also had positive net impacts on standardized mathematics proficiency. Thus, not only does teacher preparation and organization play a major role in students' specific course achievement, its presence in the overall curricular experience also appears to have positive implications for students' general cognitive development during the first year of college.

Second, and perhaps most important from a policy standpoint, many of the constituent elements of teacher organization and preparation would appear to be learnable by college faculty. For example, some of the items operationalizing the teacher organization and preparation scale employed in the study were: "presentation of material is well organized," "class time is used effectively," and "course goals and requirements are clearly explained." Such elements of teacher behavior can themselves be learned through purposeful teaching improvement efforts at the department, college or institutional level (Weimer, 1990).

Three additional issues with respect to the findings of the study are worthy of mention: 1) the modest size of the net effects uncovered, 2) the potential causal mechanisms underlying the findings, and 3) the failure of teacher skill/clarity to have a significant influence on any first-year cognitive outcomes. Research on teacher evaluations and course achievement suggests an average correlation of about .50 between teacher organization/preparation and student

achievement in any particular course. Our results suggest a net positive impact of teacher organization/preparation in the total curricular experience on general measures of cognitive development that is substantially smaller in magnitude. This is perhaps not overly surprising for two reasons. First, research on teacher behaviors and course achievement links teacher behaviors in specific courses to achievement in that course. Moreover, as McKeachie (1987) points out, the course-level achievement tests used in the preponderance of existing research emphasize definitions and recall of facts rather than higher-level comprehension, problem solving, and critical thinking. The present study attempted to link teacher behaviors on a much broader scale, the overall teaching received in the first year of college, to general measures of cognitive functioning that may have only marginal rela nships with the factual knowledge conveyed in specific courses. Second, existing research has typically reported only the simple, or zero-order,correlations between teacher behaviors and course achievement. Few if any attempts have been made to estimate the magnitude of the link between teacher behaviors and course achievement while statistically controlling for potentially confounding influences. The present study sought to control for an array of potentially confounding influences. This probably also contributed to the substantially more modest magnitude of the net effects we report.

Second, as suggested by Feldman (1994), the psychological and social psychological mechanisms underlying the link between teacher behaviors and student learning may be particularly complex, and not as simple or obvious as may be presumed. Indeed, the specific "mechanisms underlying the link between teacher organization and student achievement have yet to be specifically and fully determined" (Feldman, 1994, p. 15). Perry (1991, p. 26), as reviewed in Feldman (1994), has hypothesized one psychological mechanism that may account

for the link.

> Instructor organization...involves teaching activities intended to structure material into units more readily accessible for students' long-term memory. An outline for the lecture provides encoding schemata and advanced organizers which enable students to incorporate new, incoming material into existing structures. Presenting linkages between content topics serves to increase the cognitive integration of the new material and to make it more meaningful, both of which should facilitate retrieval.

Perry's (1991) hypothesis clearly applies most directly to the link between teacher organization/preparation and specific course content mastery. Yet, it may also have significant indirect implications for the learning of higher-order cognitive skills. By facilitating the efficient acquisition of factual knowledge and definitions teacher organization and preparation may allow for greater instructional emphasis on more general and higher-order cognitive skills. Similarly, a growing body of evidence suggests that sound content knowledge is a necessary foundation for higher-order and creative intellectual performance (e.g., Rabinowitz & Glaser, 1985). To the extent that teacher organization and preparation facilitates efficient acquisition of factual content knowledge it may also be providing a more effective foundation from which students can progress toward complex and general cognitive capabilities. Of course this is only a tentative hypothesis, and the causal mechanisms underlying the link between teacher organization/preparation and the development of general cognitive skills during college remains a fruitful area for further inquiry.

Finally, the failure of teacher skill/clarity to positively influence general cognitive

development is inconsistent with research on the influence of that teacher behavior on course-level achievement. While it is difficult to identify the specific reason for this inconsistency, two tentative explanations come to mind. First, it may be that teacher skill/clarity has a proximal impact on student learning that is primarily exerted at the course level. In contrast, teacher organization/preparation may have a more pervasive influence on both course-level achievement and non-course specific cognitive development because it establishes a supportive instructional context that enhances learning. Second, it may be that for general cognitive development the impact of a teacher is not so much in the skill and clarity of his or her presentation of content as in the establishing of an organizational context or framework that facilitates students' acquisition of complex and general cognitive skills.

LIMITATIONS

This investigation has several limitations that should be kept in mind when interpreting the findings. First, although the overall sample is multiinstitutional and consists of a broad range of four-year institutions from around the country, the fact that the analyses were limited to a sample of 18 four-year colleges means that we cannot necessarily generalize the results to all four-year institutions in the United States. Similarly, although attempts were made in the initial sampling design and subsequent sample weighting to make the sample as representative as possible at each institution, the time commitment and work required of each student participant undoubtedly led to some self-selection. We cannot be sure that those who were willing to participate in the study responded in the same way as would those who were invited but declined to participate in the study. Weighed against this, however, is the fact that we found no significant conditional effects involving such factors as age, precollege academic aptitude and academic motivation, credit hours taken, work responsibilities, or course taking patterns. Thus, even if the sample had some bias on these factors it did not appear to have an appreciable influence on the study results. Third, while we looked at several different measures of cognitive development in college (reading comprehension, mathematics and critical thinking), these are certainly not the only dimensions along which students develop intellectually during the college years. Alternative conceptualizations or approaches to the assessment of cognitive development might have produced findings different from those yielded by this investigation. Finally, this study is limited by the fact that it was only able to trace cognitive growth over the first year of college. We cannot be sure that the results we report would hold for subsequent years in college.

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TABLE 1

COMPOSITION OF TWO TEACHER BEHAVIOR SCALES

SCALE/ ITEM	ITEM-TOTAL SCALE CORRELATION	ALPHA RELIABILITY
TEACHER ORGANIZATION AND PREPARATION		.874
Presentation of material is well organized	.711	
Instructors are well prepared for class	.766	
Class time is used effectively	.678	
Course goals and requirements are clearly explained	.712	
Instructors have good command of what they are teaching	.652	
TEACHER INSTRUCTIONAL SKILL AND CLARITY		.863
Instructors give clear explanations	.683	
Instructors make good use of examples to get across difficult points	.707	
Instructors effectively review and summarize the material	.698	
Instructors interpret abstract ideas and theories clearly	.745	
Instructors answer my questions in a way that helps me understand the material	.579	

TABLE 2

REGRESSION ANALYSIS SUMMARIES*

PREDICTOR	READING COMPREHENSION	MATHEMATICS	CRITICAL THINKING	COMPOSITE COGNITIVE DEVELOPMENT
Individual Precollege Reading Comprehension, Mathematics, Critical Thinking, or Composite Cognitive Development	.604** (.609)	.643** (.664)	.719** (.666)	.264** (.787)
Average Precollege Reading Comprehension, Mathematics, Critical Thinking, or Composite Cognitive Development for First-Year Students at Each Institution	.250** (.118)	.234** (.139)	.149** (.067)	.019** (.066)
Precollege Academic Motivation	-.134 (-.013)	.105 (.013)	.191 (.018)	.009 (.006)
Female	.357 (.032)	-.525** (-.059)	.183 (.016)	.013 (.007)
Non-White	-1.125** (-.099)	-.435* (-.048)	-.673** (-.057)	-.074* -.043
Age	.030 (.026)	-.036* (-.039)	.034 (.029)	.002 .009
Number of Credit Hours Taken	.254** (.064)	.091 (.029)	.322** (.078)	.029* (.048)
Number of Hours Worked	.000 (.000)	-.048 (-.030)	-.029 (-.015)	-.003 (-.011)
Number of Courses Taken in the Natural Sciences or Engineering	.049 (.013)	.129** (.043)	.094 (.025)	.007) (.012)
Number of Courses Taken in the Arts and Humanities	.041 (.018)	-.052 (-.029)	.082 (.035)	.001 (.002)

TABLE 2 (Continued)

PREDICTOR	READING COMPREHENSION	MATHEMATICS	CRITICAL THINKING	COMPOSITE COGNITIVE DEVELOPMENT
Number of Courses Taken in the Social Sciences	.097 (.034)	-.108** (-.048)	.104 (.035)	.002 (.002)
Number of Courses Taken in Mathematics	.005 (.001)	.374** (.104)	.123 (.026)	.031** (.046)
Number of Courses Taken in Technical/Professional Areas	-.252** (-.063)	-.114* (-.035)	-.322* (-.077)	-.028** (-.046)
Teacher Organization and Preparation	.800** (.075)	.404* (.047)	.657* (.060)	.089** (.055)
Teacher Instructional Skill and Clarity	-.127 (-.012)	-.091 (-.011)	-.328 (-.031)	-.021 (-.014)
R^2	.585**	.702**	.615**	.777**

*Top number is the metric or unstandardized coefficient, number in parentheses is the standardized (beta) coefficient.

*$p < .01$
**$p < .001$

TABLE 3

Zero-Order (r) and Partial (r_p) Correlations Between Two Teacher Behavior Scales and End-of-First Year Cognitive Outcomes*

TEACHER BEHAVIOR SCALE	READING COMPREHENSION	MATHEMATICS	CRITICAL THINKING	COMPOSITE COGNITIVE DEVELOPMENT
Teacher Organization and Preparation				
r	.195**	.103**	.191**	.191**
r_p	.099**	.070*	.060*	.093**
Teacher Instructional Skill and Clarity				
r	.078**	-.016	.064*	.050
r_p	.056*	.036	.012	.047

*Partial correlations are with controls for: individual precollege aptitude, the average aptitude of the first-year students at each institution, gender ethnicity, age, credit hours taken, hours worked, and number of courses taken in natural sciences and engineering, arts and humanities, social sciences, mathematics or statistics, and technical/professional areas.

*$p < .01$
**$p < .001$